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(71)Applicant : **MICRONICS JAPAN CO LTD**
(72)Inventor : **HIRAI YUKIHIRO**
HASEGAWA MASASHI

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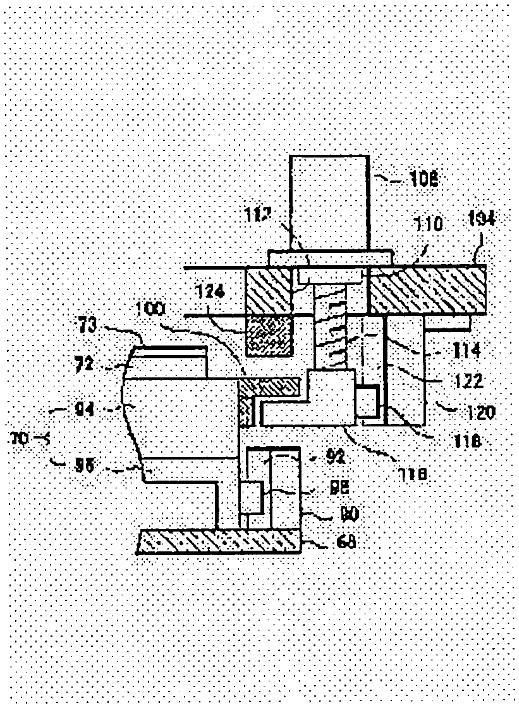
(54) DEVICE AND METHOD FOR INSPECTING PLATE-SHAPED OBJECT TO BE INSPECTED

(57)Abstract:



PROBLEM TO BE SOLVED: To prevent unbalanced load generated by the probe pressure of a probe unit from acting on a measurement stage by raising a Z-stage by means of a Z-drive source provided on the outside of the measurement stage, by not incorporating the drive mechanism of the Z-stage in the measurement stage.

SOLUTION: Alignment between a probe and the electrode of a glass substrate 73 is made by finely adjusting an X-stage, a Y-stage, and a θ-stage. Upon completion of the alignment, four Z-up blocks 116 are raised by synchronously driving four Z-motors 108. When the blocks 116 are raised, the blocks 116 come into contact with and raise Z-up wear plates 100, and a Z-stage 70 rises as a whole. When the wear plates 100 come into contact with Z-up stoppers 124, the rising of the Z-stage 70 is discontinued. When the stage 70 stops, the probe 126 of a probe unit comes into contact with the electrode of a glass substrate 73 on a chuck top 72.

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CLAIMS

[Claim(s)]
[Claim 1] Test equipment of a plate-like inspected object equipped with the following (b) - (h).
(b) It is X stage movable in the direction of X to a pedestal.
(b) Be on said X stage and it is Y stage movable in the direction perpendicular to said direction of X of Y to said X stage.
(c) Be on said Y stage and it is theta stage pivotable around the Z-axis perpendicular to XY flat surface to said Y stage.
(d) The Z stage which is a Z stage which is combined only with the Z direction movable to the aforementioned theta stage, and does not have a driving source, and can support a plate-like inspected object in parallel with XY flat surface.
(e) The base plate fixed to said pedestal.
(**) The probe unit which is a probe unit fixed to said base plate, and is equipped with the probe which can contact the electrode of said inspected object.
(g) Z driving source attached in said base plate.
(h) The engagement device in which it is the engagement device driven by said Z driving source, and it can engage with said Z stage, said Z stage can be moved to a Z direction toward said probe unit, it can have, and the electrode of said inspected object on said Z stage can be contacted to said probe.
[Claim 2] Test equipment characterized by transposing "Z driving source attached in said base plate" of said (g) to "the driving source attached in said pedestal" in test equipment according to claim 1.
[Claim 3] Test equipment with which Z rise corrosion plate prolonged in the direction of X is being fixed to the side face of said Z stage in test equipment according to claim 1 or 2, and said engagement device is characterized by including Z rise block which can contact said Z rise corrosion plate from a lower part.
[Claim 4] The inspection approach of a plate-like inspected object equipped with (**) of a degree - (Ha) a phase.
(b) The phase of putting a plate-like inspected object on the Z stage with which the movable measurement stage is equipped to the pedestal. Here, said Z stage is movable to a Z direction by Z driving source which exists in the exterior of said measurement stage, without having a driving source in itself.
(b) The phase which carries out alignment of said inspected object to a probe unit by making it rotate around the Z-axis perpendicular to said XY flat surface using said measurement stage while making the advancing-side-by-side migration of said inspected object carry out in the two-dimensional direction in XY flat surface parallel to said inspected object.
(c) The phase of making it moving to a Z direction by said Z driving source, having said Z stage, and contacting the electrode of said inspected object to the probe of said probe unit.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the test equipment and the inspection approach which are used for the energization testing device of a plate-like inspected object like a liquid crystal display panel.
[0002]
[Description of the Prior Art] There is the so-called thing of the piece tab method which equipped with many electrodes two sides which a rectangle adjoins, respectively as one of the gestalten of a liquid crystal display panel which has a rectangular configuration.
[0003] Drawing 8 is the top view of the conventional test equipment for inspecting the liquid crystal display panel of such a piece tab method, and drawing 9 is the front view. In drawing 9 , this test equipment consists of a cassette installation base 10, the loader section 12, and a test section 14. In drawing 8 , there are two substrate cassettes 16 in the cassette installation base 10, and two or more liquid crystal display panels can be held, respectively. In drawing 9 , there is a carrier robot 18 in the loader section 12, and this carrier robot 18 conveys a liquid crystal display panel between the substrate cassette 16 and a test section 14. In drawing 8 and drawing 9 , there are a step 20, a control panel 22, a monitor 24, a microscope 26, a probe unit 28, etc. in a test section 14. The probe unit 28 contacts the electrode of the glass substrate of a liquid crystal display panel in a probe.
[0004] Drawing 10 is the top view of the conventional measurement stage in which the probe unit 28 of drawing 8 is formed caudad, and shows the condition of having removed the top chuck top. Drawing 11 is the front view of the measurement stage shown in drawing 10 , and drawing 12 is the A-A line sectional view of drawing 10 . In drawing 11 and drawing 12 , this measurement stage is equipped with the X stage 30 movable in the direction of X, the Y stage 32 movable in the direction of Y, the theta stage 34 made theta rotation around the Z-axis, and Z stage 36 which can go up and down to a Z direction sequentially from the bottom. The chuck top 38 is on Z stage 36. On it, the chuck top 38 does vacuum adsorption of the glass substrate, and can be fixed. The chuck top 38 is a square and can put the rectangular glass substrate 39 (see drawing 12) on every sense.
[0005] If the X motor 40 rotates, the X stage 30 will move in the direction of X in a pedestal 41 top. If the Y motor 42 rotates, the Y stage 32 will move in the direction of Y in the X stage 30 top. If the theta motor 44 (see drawing 10) rotates, the theta stage 34 will do theta rotation of the surroundings of the Z-axis on the Y stage 32. If the Z motor 46 rotates, Z stage 36 will go up and down to a Z direction on the theta stage 34. In drawing 10 , four Z guide bases 48 are being fixed to the inferior surface of tongue of Z stage 36 of an outline octagon, it has extended caudad and the guide 49 is being fixed to this Z guide base 48. On the other hand, four guide-rail stanchions 50 are being fixed to the top face of the theta stage 34, it has extended up and the guide rail 52 is being fixed to this guide-rail stanchion 50. The guide 49 of Z stage 48 is engaging with this guide rail 52 possible [a slide]. Moreover, the eight back up plate 54 (also see drawing 12) is also being fixed to the inferior surface of tongue of Z stage 36.
[0006]

[Problem(s) to be Solved by the Invention] When a probe contacts the electrode on a glass substrate, an unbalanced load will act on a glass substrate by the stylus pressure. If a glass substrate is enlarged, the effect of the unbalanced load will become remarkable. If the chuck top bends according to an unbalanced load, the phenomenon from which a probe separates from a substrate electrode will be caused. In order to prevent bending of the chuck top by such unbalanced load, it is necessary to raise the rigidity of a measurement stage. In the conventional example shown in above-mentioned drawing 10 - drawing 12 , in order to raise the rigidity of a measurement stage, the back up plate 54 is formed in Z stage 36. Moreover, also about X stage, Y stage, and theta stage, it is necessary to raise each rigidity so that each stage may not bend according to an unbalanced load.
[0007] If it is made the structure which raised the rigidity of a measurement stage, the whole measurement stage will be enlarged and the height of a measurement stage will become high. Thereby, a manufacturing cost also becomes high. If the height of a measurement stage becomes high, the height of the test-section 14 whole of drawing 9 will also become high, and a manufacturing cost will become still higher.
[0008] It is made in order that this invention may solve an above-mentioned trouble, and even if an inspected object enlarges the purpose, it is to offer test equipment and the inspection approach without the need of raising the rigidity of a measurement stage.
[0009]
[Means for Solving the Problem] The test equipment of this invention is equipped with the following (b) - (h). (b) It is X stage movable in the direction of X to a pedestal. (b) Be on said X stage and it is Y stage movable in the direction perpendicular to said direction of X of Y to said X stage. (c) Be on said Y stage and it is theta stage pivotable around the Z-axis perpendicular to XY flat surface to said Y stage. (d) The Z stage which is a Z stage which is combined only with the Z direction movable to the aforementioned theta stage, and does not have a driving source, and can support a plate-like inspected object in parallel with XY flat surface. (e) The base plate fixed to said pedestal. (**) The probe unit which is a probe unit fixed to said base plate, and is equipped with the probe which can contact the electrode of said inspected object. (g) Z driving source attached in said base plate. (h) The engagement device in which it is the engagement device driven by said Z driving source, and it can engage with said Z stage, said Z stage can be moved to a Z direction toward said probe unit, it can have, and the electrode of said inspected object on said Z stage can be contacted to said probe.
[0010] "Z driving source attached in said base plate" of said (g) may be transposed to "the driving source attached in said pedestal."
[0011] Moreover, the inspection approach of this invention is equipped with (**) of a degree - (Ha) a phase. (b) The phase of putting a plate-like inspected object on the Z stage with which the movable measurement stage is equipped to the pedestal. Here, said Z stage is movable to a Z direction by Z driving source which exists in the exterior of said measurement stage, without having a driving source in itself. (b) The phase which carries out alignment of said inspected object to a probe unit by making it rotate around the Z-axis perpendicular to said XY flat surface using said measurement stage while making the advancing-side-by-side migration of said inspected object carry out in the two-dimensional direction in XY flat surface parallel to said inspected object. (c) The phase of making it moving to a Z direction by said Z driving source, having said Z stage, and contacting the electrode of said inspected object to the probe of said probe unit.
[0012] Thus, he is trying for this invention to raise a Z stage by Z driving source in the exterior of a measurement stage, without building into a measurement stage the drive of a Z stage in which the inspected object appears. Even if the unbalanced load by stylus pressure acted on an inspected object, the measurement stage stopped thereby, influencing of the unbalanced load. Even if an inspected object was enlarged, it became unnecessary therefore, to raise the rigidity of a measurement stage.
[0013] As a plate-like inspected object in this invention, the substrate of flat display panels, such as a liquid crystal display panel and a plasma display panel, can be considered. Moreover, it is effective if it is a comparatively large-sized substrate not only this but plate-like, and this invention is adopted.
[0014]

[Embodiment of the Invention] Drawing 1 is the front view showing the 1st operation gestalt of the test equipment of this invention, drawing 2 is the top view and drawing 3 is the B-B line sectional view of drawing 2 . Drawing 1 is seen from the right-hand side of drawing 2 . In drawing 1 , this test equipment is caudad equipped with the measurement stage 62 for the probe unit 60 up. The measurement stage 62 is equipped with the X stage 64 movable in the direction of X, the Y stage 66 movable in the direction of Y, the theta stage 68 made theta rotation around the Z-axis, and Z stage 70 which can go up and down to a Z direction sequentially from the bottom. The chuck top 72 is on Z stage 70. On it, the chuck top 72 does vacuum adsorption of the glass substrate 73 of a liquid crystal display panel, and can be fixed. In addition, a flat surface parallel to a glass substrate 73 is a XY flat surface, and the direction of X and the direction of Y lie at right angles mutually in this XY flat surface. And a direction perpendicular to this XY flat surface is a Z direction.

[0015] Rotation of X motor (are in the direction on the left of drawing 1 , and not shown) rotates a leading screw 74 (see drawing 2). In drawing 3 , since the lead nut 76 prepared in the inferior surface of tongue of the X stage 64 has got into gear to the leading screw 74, if X motor rotates, the X stage 64 will move in the direction of X in the guide-rail 78 top prepared in the stationary pedestal 77.

[0016] In drawing 1 , if the Y motor 80 rotates, the Y stage 66 will move in the direction of Y through a leading screw and a lead nut in a guide-rail 82 top.

[0017] In drawing 3 , rotation of theta motor (are before drawing 3 and not shown) rotates a leading screw 84. The lead nut 86 which has got into gear to this leading screw 84 is combined with the theta stage 68 through a link. Thereby, rotation of theta motor rotates the theta stage 68 around the Z-axis (it has extended in the direction of a vertical). The theta stage 68 is supported pivotable on the Y stage 66 with the bearing 62 of a center section, and four curvilinear guides 88 of a periphery.

[0018] Drawing 4 is the enlarged drawing to which a part of drawing 3 was expanded. Four Z stanchions 90 stand on the top face of the theta stage 68, and the Z guide rail 92 is formed in each. Z stage 70 consists of back light equipment 94 and the Z base 96. Four Z guides 98 are being fixed to the side face of the Z base 96, and this Z guide 98 can move to it up and down along with the above-mentioned Z guide rail 92. Thus, Z stage 70 is combined only with the Z direction movable to the theta stage 68. In addition, without having a driving source in itself, Z stage 70 is moved by Z motor which exists in the exterior of a measurement stage so that it may mention later.

[0019] Z rise corrosion plate 100 of an inverted-L character form is being fixed to two side faces (side face parallel to the X-axis) of back light equipment 94 for the cross section. This Z rise corrosion plate 100 is prolonged for a long time in the direction of X, as shown in drawing 1 , and it is projected on both sides rather than the dimension of the direction of X of Z stage 70.

[0020] Next, the near structure of a probe unit is explained. In drawing 1 , four stanchions 102 stand on the pedestal 77, and the base plate 104 is being fixed to the upper limit of this stanchion 102. The probe unit 60 is attached in the base plate 104 in drawing 3 . Moreover, as shown in drawing 2 , four Z motors 108 (it is equivalent to Z driving source in this invention) are attached near the four corners of the opening 106 of the center of a base plate 104.

[0021] In drawing 4 , the Z motor 108 is a hollow motor and Z lead nut 110 is being fixed to the rotator. This Z lead nut 110 has entered into the through tube 112 formed in the base plate 104. On the other hand, the Z leading screw 114 has geared in Z lead nut 110, ran through the through tube 112 from the interior of the Z motor 108, and is prolonged under the base plate 104. Z rise block 116 (it is equivalent to the engagement device in this invention) of L typeface is being fixed to the lower limit of the Z leading screw 114. Z rise guide 118 is being fixed to the side face of Z rise block 116. On the other hand, four Z rise stanchions 120 are being fixed to the inferior surface of tongue of a base plate 104, and Z rise rail 122 is being fixed to this Z rise stanchion 120. Z rise guide 118 of Z rise block 116 can be slid along with Z rise rail 122. If the Z motor 108 rotates, Z lead nut 110 will rotate, the Z leading screw 114 will go up and down, and Z rise block 116 will go up and down. If Z rise block 116 goes up, the tip will contact Z rise corrosion plate 100 from a lower part, and will lift Z rise corrosion plate 100. A rise of Z rise corrosion plate 100 raises the Z stage 70 whole. Z rise stopper 124 is being fixed to the inferior surface of tongue of a base plate 104. If Z rise corrosion plate 100 asks Z rise stopper 124, the rise of Z

stage 70 will stop.
[0022] Next, actuation of this test equipment is explained. In drawing 1, the measurement stage 62 in which the glass substrate 73 of a liquid crystal display panel was carried in the loader section is that the X stage 64 moves in the direction of X, and is moved to a test section. At this time, as shown in drawing 4, Z rise corrosion plate 100 enters between Z rise block 116 and Z rise stopper 124. And alignment (alignment) of a probe and the electrode of a glass substrate 73 is carried out by tuning finely the X stage 64 and the Y stage 66 which are shown in drawing 1, and the theta stage 68. If alignment is completed, in drawing 4, four Z motors 108 will be driven synchronously and four Z rise blocks 116 will be raised. If Z rise block 116 goes up, Z rise corrosion plate 100 will be contacted, this will be raised, and the Z stage 70 whole will go up. If Z rise corrosion plate 100 asks Z rise stopper 124, the rise of Z stage 70 will stop. This is the upper limit location of Z stage 70. Drawing 5 shows the condition of Z stage 70 having gone up from the condition of drawing 3, and having stopped in the upper limit location. At this time, the probe 126 of the probe unit 60 contacts the electrode of the glass substrate 73 on the chuck top 72. In carrying out lighting inspection, with the back light of back light equipment 94, lighting is applied and it inspects the lighting condition of a liquid crystal display panel. If inspection is completed, inverse rotation of the Z motor 108 will be carried out, and Z rise block 116 will be lowered. Then, Z stage 70 falls in a self-weight.
[0023] Thus, in this invention, since Z stage 70 in which the glass substrate 73 appears can pull up with Z rise block 116 driven by the Z motor 108 formed in the base plate 104 as shown in drawing 4, there are the following advantages. The stylus pressure of a probe does not act [1st] on the X stage 64, the Y stage 66, and the theta stage 68 of drawing 1. The base plate 104 will have received stylus pressure through Z rise corrosion plate 100, Z rise block 116, and the Z motor 108. Therefore, each above-mentioned stages 64, 66, and 68 do not receive the unbalanced load by stylus pressure. Therefore, there is no possibility that these stages may be bent by the unbalanced load, and it does not need to raise the rigidity of these stages. Since, as for Z stage 70, itself does not have [2nd] a drive, the structure of a Z stage can be simplified. Since Z stage 70 is supported [3rd] near [that] upper limit in drawing 4 by Z (Z rise corrosion plate 100 of almost same height as the chuck top 72 by the way) rise block 116 at the time of contact, even if stylus pressure acts on the chuck top 72 on Z stage 70, four Z rise blocks 116 will support this stylus pressure. There is no possibility that an unbalanced load may not act caudad rather than Z rise corrosion plate 100, and the Z stage 70 whole may bend by this. Therefore, it is not necessary to raise the rigidity of Z stage 70. It is sufficient if the rigidity which is extent by which itself is not bent is secured at most only about the top-face plate of the chuck top 72 and back light equipment 94. Since all the XYtheta Z stages can make rigidity lower than before as mentioned above the 4th, the height of a measurement stage can be made lower than before. Thereby, a measurement stage becomes cheap. And if the height of a measurement stage can be made low, the height of the whole test equipment will also be lower than before, it can do, and the whole test equipment will also become cheap.
[0024] Drawing 6 is the front view of the 2nd operation gestalt of this invention, and is equivalent to drawing 1 of the 1st operation gestalt. Drawing 7 is the sectional view of the equipment of drawing 6, and is equivalent to drawing 3 of the 1st operation gestalt. The place where this 2nd operation gestalt differs from the 1st operation gestalt, the device in which a Z stage is raised is attached direct picking at a pedestal. In drawing 6 and drawing 7, it is fixed to the pedestal 77 so that four pneumatic cylinders 128 may stand straight. The cylinder rod 130 of each pneumatic cylinder 128 can be gone up and down. Z rise block 132 is being fixed to the upper limit of each cylinder rod 130. A rise of the cylinder rod 130 raises Z rise block 132. If Z rise block 132 goes up, Z rise corrosion plate 100 will be contacted from a lower part, this will be raised, and Z stage 70 will be raised. If Z rise corrosion plate 100 asks Z rise stopper 124, Z stage 70 will stop there. Parts other than the device in which a Z stage is raised are the same as the 1st operation gestalt.
[0025] This invention is not limited to an above-mentioned operation gestalt, but the following modification is possible for it. (1) The driving source of arbitration, such as an electric motor, a pneumatic cylinder, and an oil hydraulic cylinder, can be used for the drive which makes it go up and

down Z rise block. (2) Although Z rise block is independently attached in each drive with the above-mentioned operation gestalt, you may make it two or more drives located in a line in the direction of X drive one Z rise block. For example, you may make it build the upper limit of the cylinder rod 130 of the pneumatic cylinder 128 on either side over long and slender Z rise block of one in the direction of X in drawing 6 . When it does so, two Z rise blocks will be driven with four drives. (3) Z rise block makes a cross section the typeface of KO, and you may make it sandwich Z rise corrosion plate from the upper and lower sides. If it carries out like this, also when lowering a Z stage, Z rise block will depress Z rise corrosion plate, and ensures descent of a Z stage. (4) You may enable it to adjust Z rise stopper's installation height with a screw. If it carries out like this, the height of the upper limit location of a Z stage, i.e., a contact location, can be adjusted.

[0026]

[Effect of the Invention] As this invention does not build the drive of a Z stage into a measurement stage, since it was made to raise a Z stage by Z driving source in the exterior of a measurement stage, it can prevent a measurement stage bending according to the unbalanced load by the stylus pressure of a probe unit. It could be managed, even if the inspected object was enlarged and it did not raise the rigidity of a measurement stage by this. Consequently, the height of a measurement stage can be made low, further, it comes to be also able to make the height of the whole test section low, and it can lower the manufacturing cost of equipment.

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EFFECT OF THE INVENTION

[Effect of the Invention] As this invention does not build the drive of a Z stage into a measurement stage, since it was made to raise a Z stage by Z driving source in the exterior of a measurement stage, it can prevent a measurement stage bending according to the unbalanced load by the stylus pressure of a probe unit. It could be managed, even if the inspected object was enlarged and it did not raise the rigidity of a measurement stage by this. Consequently, the height of a measurement stage can be made low, further, it comes to be also able to make the height of the whole test section low, and it can lower the manufacturing cost of equipment.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] When a probe contacts the electrode on a glass substrate, an unbalanced load will act on a glass substrate by the stylus pressure. If a glass substrate is enlarged, the effect of the unbalanced load will become remarkable. If the chuck top bends according to an unbalanced load, the phenomenon from which a probe separates from a substrate electrode will be caused. In order to prevent bending of the chuck top by such unbalanced load, it is necessary to raise the rigidity of a measurement stage. In the conventional example shown in above-mentioned drawing 10 - drawing 12 , in order to raise the rigidity of a measurement stage, the back up plate 54 is formed in Z stage 36. Moreover, also about X stage, Y stage, and theta stage, it is necessary to raise each rigidity so that each stage may not bend according to an unbalanced load.
[0007] If it is made the structure which raised the rigidity of a measurement stage, the whole measurement stage will be enlarged and the height of a measurement stage will become high. Thereby, a manufacturing cost also becomes high. If the height of a measurement stage becomes high, the height of the test-section 14 whole of drawing 9 will also become high, and a manufacturing cost will become still higher.
[0008] It is made in order that this invention may solve an above-mentioned trouble, and even if an inspected object enlarges the purpose, it is to offer test equipment and the inspection approach without the need of raising the rigidity of a measurement stage.

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MEANS

[Means for Solving the Problem] The test equipment of this invention is equipped with the following (b) - (h). (b) It is X stage movable in the direction of X to a pedestal. (b) Be on said X stage and it is Y stage movable in the direction perpendicular to said direction of X of Y to said X stage. (c) Be on said Y stage and it is theta stage pivotable around the Z-axis perpendicular to XY flat surface to said Y stage. (d) The Z stage which is a Z stage which is combined only with the Z direction movable to the aforementioned theta stage, and does not have a driving source, and can support a plate-like inspected object in parallel with XY flat surface. (e) The base plate fixed to said pedestal. (**) The probe unit which is a probe unit fixed to said base plate, and is equipped with the probe which can contact the electrode of said inspected object. (g) Z driving source attached in said base plate. (h) The engagement device in which it is the engagement device driven by said Z driving source, and it can engage with said Z stage, said Z stage can be moved to a Z direction toward said probe unit, it can have, and the electrode of said inspected object on said Z stage can be contacted to said probe.
[0010] "Z driving source attached in said base plate" of said (g) may be transposed to "the driving source attached in said pedestal."
[0011] Moreover, the inspection approach of this invention is equipped with (**) of a degree - (Ha) a phase. (b) The phase of putting a plate-like inspected object on the Z stage with which the movable measurement stage is equipped to the pedestal. Here, said Z stage is movable to a Z direction by Z driving source which exists in the exterior of said measurement stage, without having a driving source in itself. (b) The phase which carries out alignment of said inspected object to a probe unit by making it rotate around the Z-axis perpendicular to said XY flat surface using said measurement stage while making the advancing-side-by-side migration of said inspected object carry out in the two-dimensional direction in XY flat surface parallel to said inspected object. (c) The phase of making it moving to a Z direction by said Z driving source, having said Z stage, and contacting the electrode of said inspected object to the probe of said probe unit.
[0012] Thus, he is trying for this invention to raise a Z stage by Z driving source in the exterior of a measurement stage, without building into a measurement stage the drive of a Z stage in which the inspected object appears. Even if the unbalanced load by stylus pressure acted on an inspected object, the measurement stage stopped thereby, influencing of the unbalanced load. Even if an inspected object was enlarged, it became unnecessary therefore, to raise the rigidity of a measurement stage.
[0013] As a plate-like inspected object in this invention, the substrate of flat display panels, such as a liquid crystal display panel and a plasma display panel, can be considered. Moreover, it is effective if it is a comparatively large-sized substrate not only this but plate-like, and this invention is adopted.
[0014]
[Embodiment of the Invention] Drawing 1 is the front view showing the 1st operation gestalt of the test equipment of this invention, drawing 2 is the top view and drawing 3 is the B-B line sectional view of drawing 2 . Drawing 1 is seen from the right-hand side of drawing 2 . In drawing 1 , this test equipment is caudad equipped with the measurement stage 62 for the probe unit 60 up. The measurement stage 62 is equipped with the X stage 64 movable in the direction of X, the Y stage 66 movable in the direction

of Y, the theta stage 68 made theta rotation around the Z-axis, and Z stage 70 which can go up and down to a Z direction sequentially from the bottom. The chuck top 72 is on Z stage 70. On it, the chuck top 72 does vacuum adsorption of the glass substrate 73 of a liquid crystal display panel, and can be fixed. In addition, a flat surface parallel to a glass substrate 73 is a XY flat surface, and the direction of X and the direction of Y lie at right angles mutually in this XY flat surface. And a direction perpendicular to this XY flat surface is a Z direction.

[0015] Rotation of X motor (are in the direction on the left of drawing 1 , and not shown) rotates a leading screw 74 (see drawing 2). In drawing 3 , since the lead nut 76 prepared in the inferior surface of tongue of the X stage 64 has got into gear to the leading screw 74, if X motor rotates, the X stage 64 will move in the direction of X in the guide-rail 78 top prepared in the stationary pedestal 77.

[0016] In drawing 1 , if the Y motor 80 rotates, the Y stage 66 will move in the direction of Y through a leading screw and a lead nut in a guide-rail 82 top.

[0017] In drawing 3 , rotation of theta motor (are before drawing 3 and not shown) rotates a leading screw 84. The lead nut 86 which has got into gear to this leading screw 84 is combined with the theta stage 68 through a link. Thereby, rotation of theta motor rotates the theta stage 68 around the Z-axis (it has extended in the direction of a vertical). The theta stage 68 is supported pivotable on the Y stage 66 with the bearing 62 of a center section, and four curvilinear guides 88 of a periphery.

[0018] Drawing 4 is the enlarged drawing to which a part of drawing 3 was expanded. Four Z stanchions 90 stand on the top face of the theta stage 68, and the Z guide rail 92 is formed in each. Z stage 70 consists of back light equipment 94 and the Z base 96. Four Z guides 98 are being fixed to the side face of the Z base 96, and this Z guide 98 can move to it up and down along with the above-mentioned Z guide rail 92. Thus, Z stage 70 is combined only with the Z direction movable to the theta stage 68. In addition, without having a driving source in itself, Z stage 70 is moved by Z motor which exists in the exterior of a measurement stage so that it may mention later.

[0019] Z rise corrosion plate 100 of an inverted-L character form is being fixed to two side faces (side face parallel to the X-axis) of back light equipment 94 for the cross section. This Z rise corrosion plate 100 is prolonged for a long time in the direction of X, as shown in drawing 1 , and it is projected on both sides rather than the dimension of the direction of X of Z stage 70.

[0020] Next, the near structure of a probe unit is explained. In drawing 1 , four stanchions 102 stand on the pedestal 77, and the base plate 104 is being fixed to the upper limit of this stanchion 102. The probe unit 60 is attached in the base plate 104 in drawing 3 . Moreover, as shown in drawing 2 , four Z motors 108 (it is equivalent to Z driving source in this invention) are attached near the four corners of the opening 106 of the center of a base plate 104.

[0021] In drawing 4 , the Z motor 108 is a hollow motor and Z lead nut 110 is being fixed to the rotator. This Z lead nut 110 has entered into the through tube 112 formed in the base plate 104. On the other hand, the Z leading screw 114 has geared in Z lead nut 110, ran through the through tube 112 from the interior of the Z motor 108, and is prolonged under the base plate 104. Z rise block 116 (it is equivalent to the engagement device in this invention) of L typeface is being fixed to the lower limit of the Z leading screw 114. Z rise guide 118 is being fixed to the side face of Z rise block 116. On the other hand, four Z rise stanchions 120 are being fixed to the inferior surface of tongue of a base plate 104, and Z rise rail 122 is being fixed to this Z rise stanchion 120. Z rise guide 118 of Z rise block 116 can be slid along with Z rise rail 122. If the Z motor 108 rotates, Z lead nut 110 will rotate, the Z leading screw 114 will go up and down, and Z rise block 116 will go up and down. If Z rise block 116 goes up, the tip will contact Z rise corrosion plate 100 from a lower part, and will lift Z rise corrosion plate 100. A rise of Z rise corrosion plate 100 raises the Z stage 70 whole. Z rise stopper 124 is being fixed to the inferior surface of tongue of a base plate 104. If Z rise corrosion plate 100 asks Z rise stopper 124, the rise of Z stage 70 will stop.

[0022] Next, actuation of this test equipment is explained. In drawing 1 , the measurement stage 62 in which the glass substrate 73 of a liquid crystal display panel was carried in the loader section is that the X stage 64 moves in the direction of X, and is moved to a test section. At this time, as shown in drawing 4 , Z rise corrosion plate 100 enters between Z rise block 116 and Z rise stopper 124. And alignment

(alignment) of a probe and the electrode of a glass substrate 73 is carried out by tuning finely the X stage 64 and the Y stage 66 which are shown in drawing 1, and the theta stage 68. If alignment is completed, in drawing 4, four Z motors 108 will be driven synchronously and four Z rise blocks 116 will be raised. If Z rise block 116 goes up, Z rise corrosion plate 100 will be contacted, this will be raised, and the Z stage 70 whole will go up. If Z rise corrosion plate 100 asks Z rise stopper 124, the rise of Z stage 70 will stop. This is the upper limit location of Z stage 70. Drawing 5 shows the condition of Z stage 70 having gone up from the condition of drawing 3, and having stopped in the upper limit location. At this time, the probe 126 of the probe unit 60 contacts the electrode of the glass substrate 73 on the chuck top 72. In carrying out lighting inspection, with the back light of back light equipment 94, lighting is applied and it inspects the lighting condition of a liquid crystal display panel. If inspection is completed, inverse rotation of the Z motor 108 will be carried out, and Z rise block 116 will be lowered. Then, Z stage 70 falls in a self-weight.

[0023] Thus, in this invention, since Z stage 70 in which the glass substrate 73 appears can pull up with Z rise block 116 driven by the Z motor 108 formed in the base plate 104 as shown in drawing 4, there are the following advantages. The stylus pressure of a probe does not act [1st] on the X stage 64, the Y stage 66, and the theta stage 68 of drawing 1. The base plate 104 will have received stylus pressure through Z rise corrosion plate 100, Z rise block 116, and the Z motor 108. Therefore, each above-mentioned stages 64, 66, and 68 do not receive the unbalanced load by stylus pressure. Therefore, there is no possibility that these stages may be bent by the unbalanced load, and it does not need to raise the rigidity of these stages. Since, as for Z stage 70, itself does not have [2nd] a drive, the structure of a Z stage can be simplified. Since Z stage 70 is supported [3rd] near [that] upper limit in drawing 4 by Z (Z rise corrosion plate 100 of almost same height as the chuck top 72 by the way) rise block 116 at the time of contact, even if stylus pressure acts on the chuck top 72 on Z stage 70, four Z rise blocks 116 will support this stylus pressure. There is no possibility that an unbalanced load may not act caudad rather than Z rise corrosion plate 100, and the Z stage 70 whole may bend by this. Therefore, it is not necessary to raise the rigidity of Z stage 70. It is sufficient if the rigidity which is extent by which itself is not bent is secured at most only about the top-face plate of the chuck top 72 and back light equipment 94. Since all the XYtheta Z stages can make rigidity lower than before as mentioned above the 4th, the height of a measurement stage can be made lower than before. Thereby, a measurement stage becomes cheap. And if the height of a measurement stage can be made low, the height of the whole test equipment will also be lower than before, it can do, and the whole test equipment will also become cheap.

[0024] Drawing 6 is the front view of the 2nd operation gestalt of this invention, and is equivalent to drawing 1 of the 1st operation gestalt. Drawing 7 is the sectional view of the equipment of drawing 6, and is equivalent to drawing 3 of the 1st operation gestalt. The place where this 2nd operation gestalt differs from the 1st operation gestalt, the device in which a Z stage is raised is attached direct picking at a pedestal. In drawing 6 and drawing 7, it is fixed to the pedestal 77 so that four pneumatic cylinders 128 may stand straight. The cylinder rod 130 of each pneumatic cylinder 128 can be gone up and down. Z rise block 132 is being fixed to the upper limit of each cylinder rod 130. A rise of the cylinder rod 130 raises Z rise block 132. If Z rise block 132 goes up, Z rise corrosion plate 100 will be contacted from a lower part, this will be raised, and Z stage 70 will be raised. If Z rise corrosion plate 100 asks Z rise stopper 124, Z stage 70 will stop there. Parts other than the device in which a Z stage is raised are the same as the 1st operation gestalt.

[0025] This invention is not limited to an above-mentioned operation gestalt, but the following modification is possible for it. (1) The driving source of arbitration, such as an electric motor, a pneumatic cylinder, and an oil hydraulic cylinder, can be used for the drive which makes it go up and down Z rise block. (2) Although Z rise block is independently attached in each drive with the above-mentioned operation gestalt, you may make it two or more drives located in a line in the direction of X drive one Z rise block. For example, you may make it build the upper limit of the cylinder rod 130 of the pneumatic cylinder 128 on either side over long and slender Z rise block of one in the direction of X in drawing 6. When it does so, two Z rise blocks will be driven with four drives. (3) Z rise block makes a cross section the typeface of KO, and you may make it sandwich Z rise corrosion plate from the upper and lower sides. If it carries out like this, also when lowering a Z stage, Z rise block will depress Z rise corrosion plate, and ensures descent of a Z stage. (4) You may enable it to adjust Z rise stopper's installation height with a screw. If it carries out like this, the height of the upper limit location of a Z stage, i.e., a contact location, can be adjusted.

[Translation done.]

* NOTICES *

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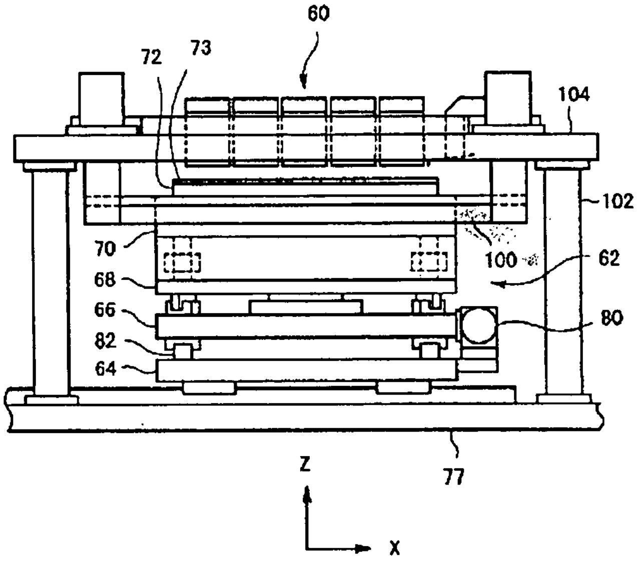
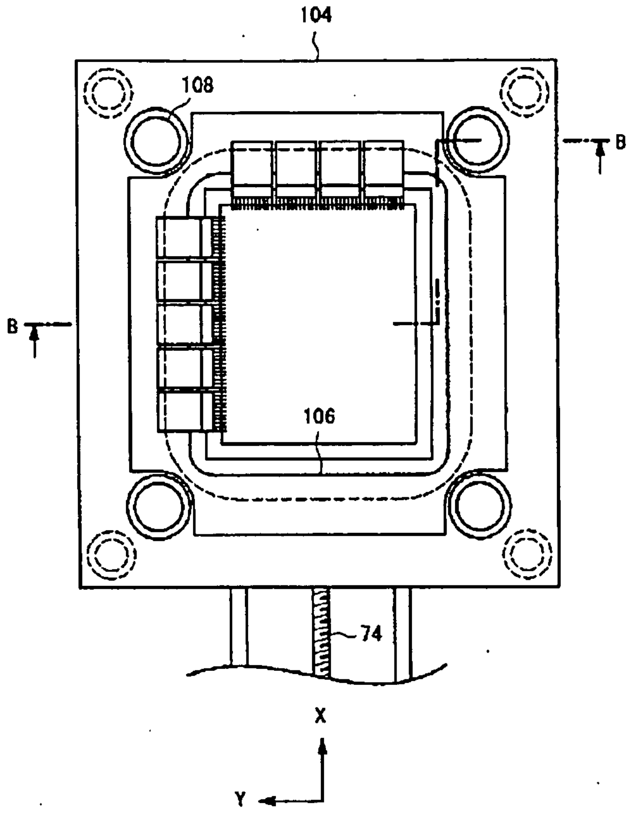
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

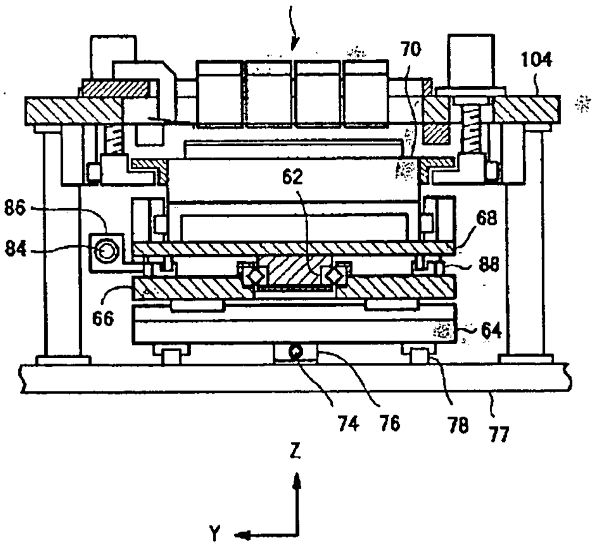
[Drawing 1]



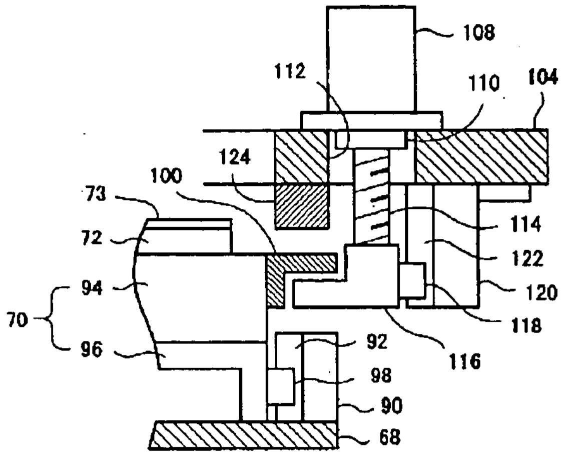
[Drawing 2]



[Drawing 3]



[Drawing 4]



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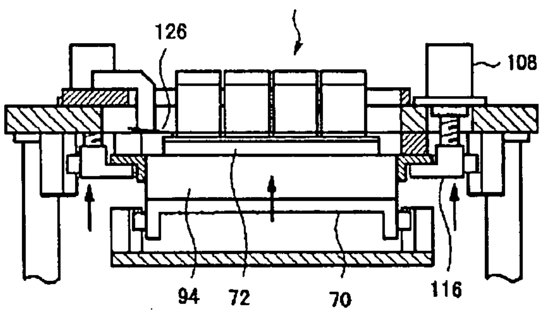
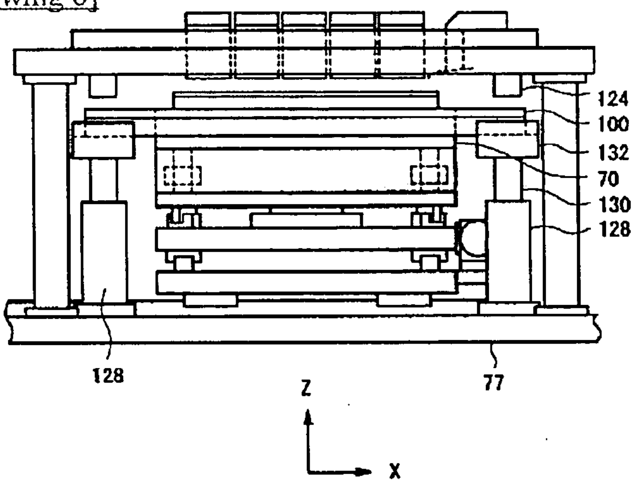
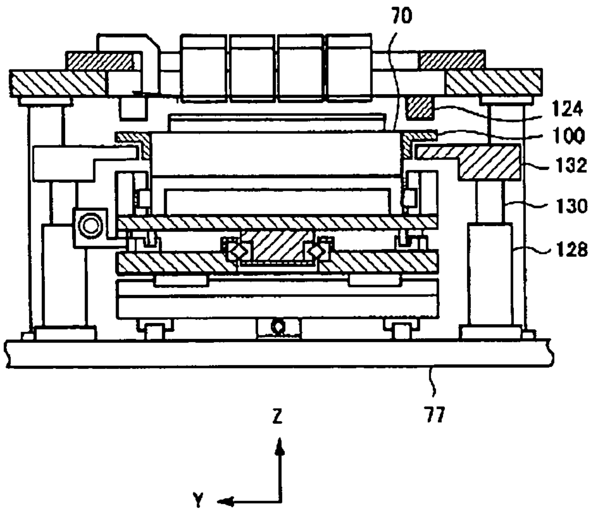


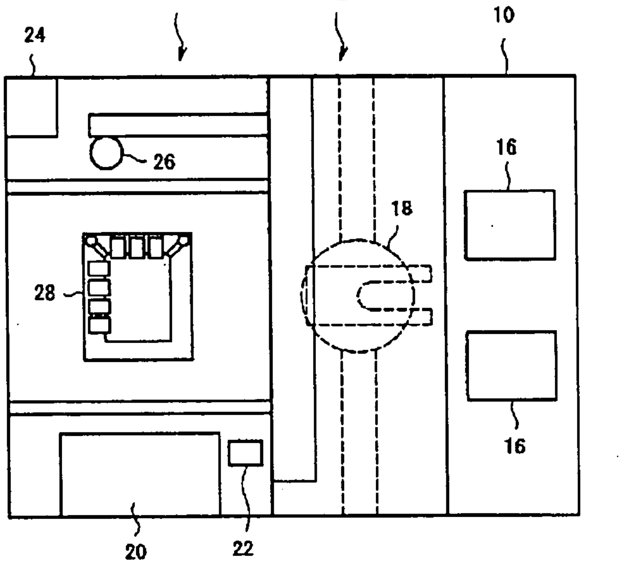
[Drawing 6]



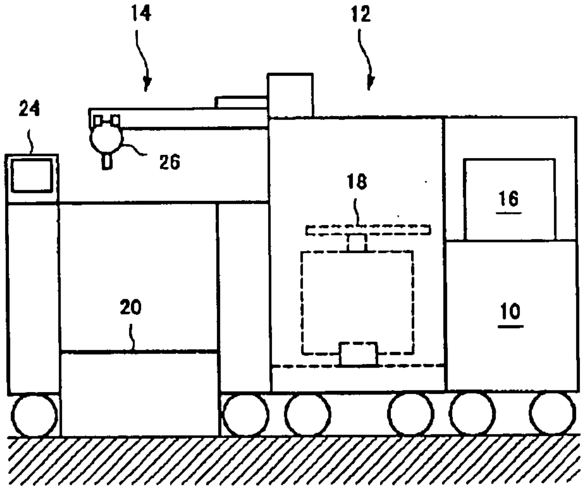
[Drawing 7]



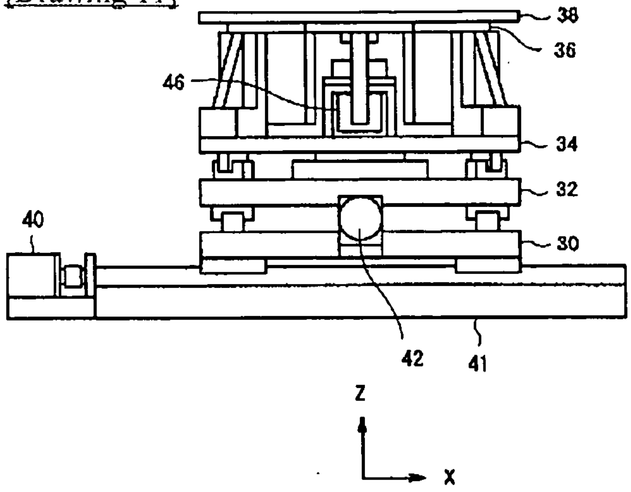
[Drawing 8]



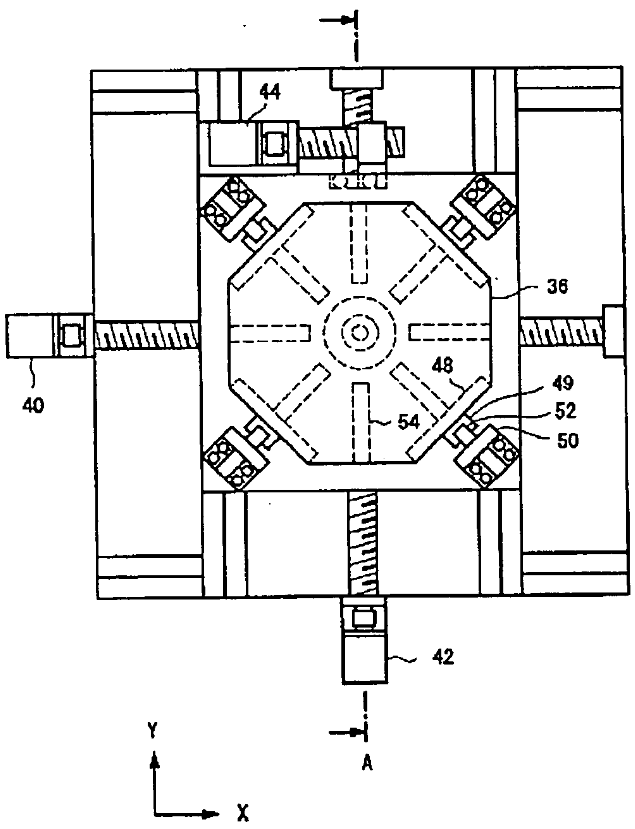
[Drawing 9]



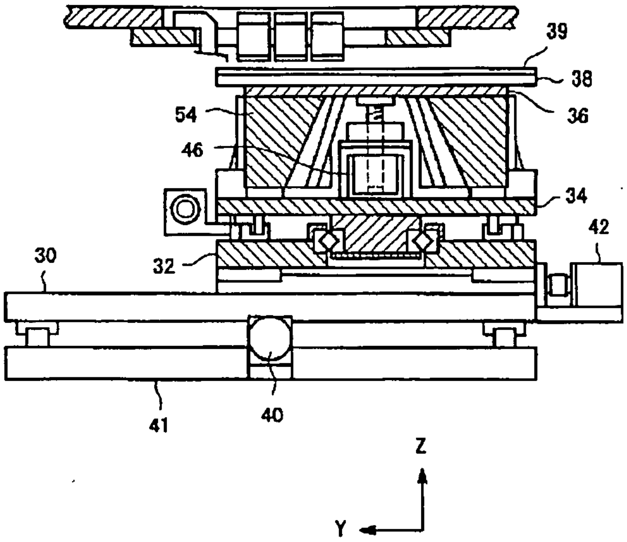
[Drawing 11]



[Drawing 10]



[Drawing 12]



[Translation done.]